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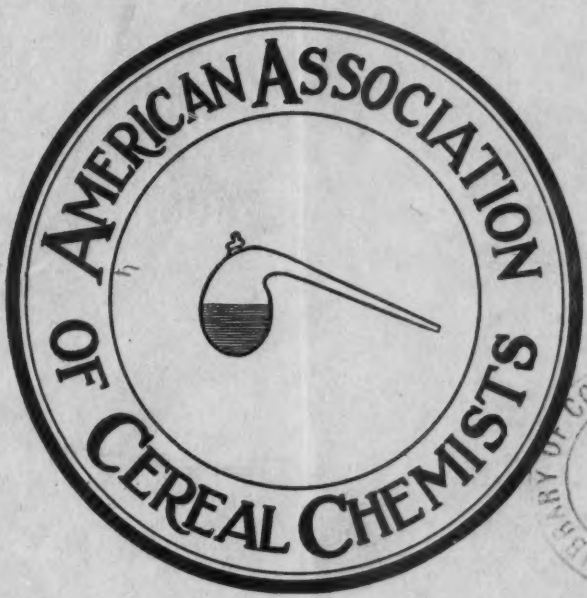

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THE JOURNAL

OF THE

AMERICAN ASSOCIATION

OF

CEREAL CHEMISTS

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VOL. III *December, 1918* NO. 1

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American Association of Cereal Chemists

The patriotic call of the nation for the branch of service best fitted for the individual is great for us all. The call is for the best, and the best are answering in the required number.

The answering of this call by R. W. Mitchell, chief chemist, Kansas Milling Company, and editor of the journal of the American Association of Cereal Chemists is an example of the highest of national loyalty.

The service of R. W. Mitchell as editor of the American Association of Cereal Chemists has been of unlimited value, and I regret that I am compelled to announce his leave from the association.

I am hoping, and I can unhesitatingly speak for all the members of the association, that Mr. Mitchell will find his way back to the association after he has fulfilled his high patriotic duty and his service to our great America. For the sustaining of the American Association of Cereal Chemists requires men who have to offer, such loyalty, untiring labor and high intellectual advice.

The American Association of Cereal Chemists has grown from an original membership of twelve, three and one-half years ago to the present enrollment of fifty-six, only through the constant hammering of a few. More directly does this apply to R. W. Mitchell, who by unceasing labor has edited the journals in a manner demanding respect from all who read them.

So it is with the highest of thoughts and sincerest desires that we accept his leave from the association, knowing the success he will procure in the noble service of the Chemical Service Section of the UNITED STATES ARMY.

C. J. PATTERSON,
President.

The leave of R. W. Mitchell, editor of the Journal of the American Association of Cereal Chemists, demands the appointment of a new editor. Knowing the condition under which we are all working during this time, I appreciate the fact that the appointment will demand the timeless labor and loyalty of a man who is not afraid.

In appointing Mr. A. A. Jones I feel I have found a new editor fully qualified and fully worthy of undertaking the publication of our journals.

And so it is with the heartiest greeting that the association accepts Mr.

A. A. Jones as editor of the publications of the American Association of Cereal Chemists.

C. J. PATTERSON,
President.

Our Sustaining Members

It is with no little pride that we are listing for the first time those firms who have shown their hearty material interest and appreciation in the work which our Association has undertaken in becoming Sustaining Members of our organization. The Journal is distributed gratis and in view of the limited number of members and the wide circulation which has been found desirable, the sustaining membership provision was created. Milling and other firms can by this means show their interest in promoting investigations of a nature to aid the cereal industries. Therefore it is with pleasure that we have given the inside front cover as a place of honor for those who are interested in our work.

Every firm which has a laboratory, especially those which have active members of this Association should become a sustaining member. Members have you done your part in presenting this matter to your employer? He is a live wire and he realizes that our meetings and publications are as necessary in standardizing and advancing our branch of science as his meetings and trade papers are to him. Our publication encourages reliable, scientific data only and you should be the first to interest your employer in our work and secure your firm's sustaining membership. In the next issue let us be able to list every firm on the front cover who employs a member of our Association.

It is not with any particular feeling of elation or high-brow aspirations either editorially or politically that the present incumbent has accepted the appointment of the unexpired term of editorship of this journal which has from the beginning been so ably held by Ralph Wallace Mitchell.

The duties thrust upon one inexperienced in such lines of work are varied and complex involving a knowledge of things hitherto unheard of, unthought of at least, and a glimpse of human nature which could be gleaned in no other way and the traditional glory for the Editor will only be that which is written on his epitaph.

Exasperating delays have been caused by neglected replies, thoughtlessness without a doubt, but at the expense of time, delayed publication, advertising, writing material and postage. Little things in a way to be sure but it is not the Editor alone who suffers the grief but the organization as a whole. We all look forward eagerly for "the next issue" of the Journal, and what pray is the next issue? It is but the concrete expression of our work of research and investigation. No thrilling stories by the cub reporter or glaring headlines of world events but the results of our painstaking, often laborious, efforts toward progress in advancing our science. The "next issue" then, being the fruit of our labor is the milestone of our work from the date of the last issue and delay in publication means delay in further research, for the publication of material in the Journal involves the coordination and assembling of data obtained which might otherwise lead to no future work and be of little value. Publication of data should be then the culmination of our ideas with the proof to back us up which will mark another stone in our forward march to success.

With peace once more on earth and a return to pre-war conditions let

each of us get down to business and first of all get at that problem or idea which we have lurking somewhere around the corner of our nearest gray cell and work out the details and proof and then write it up and send it in. And lastly, don't neglect to answer correspondence promptly.

THE K. C. MEETING

Coates House, Kansas City, Mo., June 3, 1918.

The Annual Meeting of the American Association of Cereal Chemists, was called to order by President Patterson at 10 a. m.

A letter was read from Secretary Olsen, sending regrets and best wishes for a successful year.

The chair appointed W. O. Gordon, as Secretary pro-tem.

The President in his annual address reviewed the year's work, and made recommendations for further research, pointing out the value of research to the chemist, the employer and the country at large. He encouraged a large general research laboratory, where problems common to many, could well be developed. The president brought out the service that had been performed, and the fact that the flour milling industry had been the last in accepting chemistry as a service.

There was read from H. E. Johnson, of the Colorado Mill & Elevator Co., a letter regretting his absence, as he had left the laboratory.

Also letter read from Ralph S. Herman, as Lieutenant of the Aerial Observation Corps in France.

Dean Yohe regrets his inability to be present, per his letter.

Letter was read from President Beavers, President of the Federation of Operative Millers' Association in regards to a delegate at the F. O. M. A. Convention at Indianapolis.

Motion was made and carried to send Mr. R. W. Mitchell of the Kansas Milling Co., Wichita, Kansas, as a delegate from this Association, and that his expenses be paid by the Association.

Following was the report of I. D. Jackson of Winnipeg, Canada, on Canadian membership.

Following came the first paper of the Association Meeting by A. A. Jones of the Larabee Flour Mills Corporation, entitled, "Some Valuable Allies Worthy of Recommendation."

Mr. Jones brought forth data concerning the use of grain sorghums as good substitutes for wheat flour, when milled on the four bushel and thirty pound basis. The flour has good color, and acts well during fermentation.

Following was a discussion of the relative merits of Kafir, Feterita and Corn.

Adjournment.

2:00 p. m., June 3.

The first paper of the afternoon was by C. R. Southwell of the Guthrie Mill and Elevator Co., Guthrie, Okla., entitled, "Extraction." The paper dealt with the use and differences in extracting with several solvents, Acetone, Carbon Disulphide, Ether, Methyl-Alcohol on samples A and B. "A" is a 1915 bin burnt poor quality flour. "B" is a 1916 fine quality flour. Both were milled to a 60 per cent extraction on an experimental mill.

J. R. Hesse, on "Enzymes of Wheat Flour Substitutes," demonstrating the presence of a series of enzymes in Whole Wheat Flour.

The paper was very interesting and the discussion indicated that the enzymes of the flour substitutes were productive of a great deal of irregularity in panification. In this connection, President Patterson read a paper, entitled, "Enzymes," from the Chemical Engineer.

H. C. Bashioum, of the Jersey City Cereal Food Co., Pittsburgh, Pa., was called upon to address the Society concerning the manufacture of Corn Flakes. He discussed also the acidity determination in respect to the amino acids and volatile fatty acids.

President Patterson quoted his experience, taking (aqueous) against alcoholic extraction.

Motion was made and carried to appoint a committee to study methods for determination of free fatty acids, also aqueous extraction.

Committee appointed, Weaver, Loomis and Bashioum.

Motion was made by Weaver to require and request Mr. R. W. Mitchell to itemize accurately his expenses to Indianapolis.

Following was read the report of the Secretary and of the Treasurer. Motion to accept the report, was carried.

Motion was made and carried to exempt members in military service from payment of dues during the period of war.

Motion was made and carried to reinstate all members who had resigned from the Association, having entered military service.

Adjournment.

9:00 a. m., June 4th.

Following were the nominations and election of officers: Nominations, L. D. Jackson, R. W. Mitchell, and C. J. Patterson. Mr. Patterson was reelected.

Nominations for Vice President: A. R. Sasse, C. W. Buck, C. R. Southwell, and W. O. Gordon. Discussion brought out the availability of Mr. Buck, present incumbent under the draft regulations. Mr. Southwell was elected.

Nominations for Secretary-Treasurer: L. R. Olsen, L. D. Jackson and W. O. Gordon. W. O. Gordon elected.

Nominations for Chairman of the Executive Committee: H. E. Weaver, L. D. Jackson, A. A. Jones, and R. W. Mitchell. Mr. Weaver elected.

Nominations for Editor of the Journal: R. W. Mitchell, A. R. Sasse, F. W. Loomis and L. D. Jackson. Mr. Mitchell elected.

Motion was made to have the dinner banquet at the Coates House. Mr. Wright and Fred E. Sterling of the Northwestern Miller, expressed their appreciation of their invitation for dinner.

Motion by A. R. Sasse to investigate the food value, the advisability, etc., of higher extraction for whole wheat flours, and desired each member to submit an expression with references, and present the same before October 1st., through a central committee, composed of: C. J. Patterson, A. R. Sasse, and R. W. Mitchell. Motion was carried.

In the formal discussion of Feterita, Kafir and Milo, it was agreed that F. W. Loomis should send at the expense of the Association, samples of each to W. O. Gordon, R. W. Mitchell, H. E. Weaver, J. M. Hogan, and A. W. Estabrook, in order that their relative merits may be determined.

The meeting adjourned to accept the invitation of the Loose-Wiles Biscuit Co., for a trip of inspection through their Cracker and Candy Plant.

9:00 a. m., June 5th.

Mr. W. O. Gordon read a paper on, "Theory and Practice in a Baking Test," in which he suggested no arbitrary standards of time and amounts of ingredients. This was followed by the annual argument by Mitchell and Weaver.

The next paper was read by L. H. McLaren of the Ismert-Hicke Milling Co., of Kansas City, Mo., on "Protein Hydrolysis," a most interesting paper, and followed by a most interesting discussion.

The suggestion was made by H. E. Weaver to adopt as official, the loaf

measuring device manufactured by the Industrial Appliance Co.

President Patterson read a paper from the Journal of Industrial & Engineering Chemistry upon, "Rancidity in Corn Products," which was followed by an elaborate discussion of its merits.

After voting thanks to all who had helped to make the meeting a success, the meeting adjourned, sine die.

Respectfully submitted,

W. O. GORDON, Secretary.

Investigations Into the Methods of Determining Soluble Protein, Reducing Sugars, Acidity and Soluble Extract: Their Causes and Effects.

Preliminary steps were taken to determine the best proportion of water to sample to use for the extraction; three trials were made using 10 gr. of sample to 250 c.c. of water, 5 gr. of sample to 250 c.c. of water and 20 gr. of sample to 250 c.c. of water.

The first two gave the same results. Using 20 grs. to 250 c.c. of water gave somewhat lower results. Ten grams to 250 c.c of water was chosen for this work. A 25 c.c. aliquot was used for all determinations. All the work was done on sound flour and wheat unless otherwise stated. The filtrations were made through an asbestos pad in a Gooch crucible, using suction, the filtrates were bright and clear. The time of such a filtration is about five minutes. Distilled water was used for all extractions. All temperatures are those of the Centigrade scale.

The first series of experiments was to determine the effect of different temperatures and length of time of extraction upon the percentages of soluble protein and acidity. Patent flour, Straight Grade Flour, Clear Flour, dry and tempered wheats were used. In the subjoined table the letter denotes the length of time the sample was extracted. No letter, denotes two hours; A, four hours; B, six hours; and C, twenty-four hours. The results follow. Ash, moisture, and protein are given for general information:

TABLE NO. 1.

Sample	Per Cent. Moisture	Per Cent. Ash	Per Cent. Tot. Protein	Sol. Protein at 10°	Acidity Room Temp.	Acidity 40°	Acidity Room At 10°	Acidity Room	Acidity 40°
Patent	13.3	.376	10.12	2.20	2.60	2.86	.081	.112	.135
Patent A	.....	.....	.....	2.36	3.00	3.08	.090	.135	.135
Patent B	.....	.....	.....	2.96	3.00	3.04	.112	.135	.135
Patent C	.....	.....	.....	.....	3.24	8.24	.....	.157	1.890
Straight	13.5	.433	10.64	1.96	2.08	2.20	.081	.090	.135
Straight A	.....	.....	.....	1.96	2.04	2.44	.135	.157	.157
Straight B	.....	.....	.....	1.96	2.44	2.52	.135	.157	.157
Straight C	.....	.....	.....	.....	2.84	8.04	.....	.225	1.62
Clear	13.3	.573	11.88	1.72	1.92	2.16	.112	.157	.225
Clear A	.....	.....	.....	1.76	2.04	2.60	.135	.187	.225
Clear B	.....	.....	.....	1.84	2.44	2.60	.157	.225	.225
Clear C	.....	.....	.....	.....	2.80	8.68	.....	.270	.810
Dry Wheat	11.2	1.82	12.04	1.64	1.72	1.96	.135	.180	.225
Dry Wheat A	....	.....	.....	1.64	1.80	2.20	.135	.270	.360
Dry Wheat B	....	.....	.....	1.64	2.08	2.68	.180	.315	.360
Dry Wheat C	....	.....	.....	.....	3.40	7.08	.....	.630	2.290
Tempered Wheat	15.0	1.58	11.72	1.80	1.96	2.28	.180	.270	.360
Tempered Wheat A	.....	.....	.....	1.80	2.04	2.36	.180	.360	.405
Tempered Wheat B	.....	.....	.....	1.96	2.36	2.64	.225	.360	.405
Tempered Wheat C	.....	.....	.....	.....	3.44	7.80	.....	.765	2.610

This series shows as might be expected that the higher the temperature and longer the extraction the greater the per cent. of acidity and soluble protein. It will be noticed however that there is no increase in acidity between the four hour period at 40° and the six hour period and in a number of cases no increase from two hour period to the six hour period at 40°. This applies to both the wheat and the flour. We may therefore conclude that four hours extraction at 40° will give the maximum acidity.

There is further increase of acidity as shown by the twenty-four hour extraction. However, this is severe treatment. It was noted after the twenty-four hour extraction that the solution was filtered with great difficulty. The solution had the odor of souring milk.

There is also no increase of soluble protein between the four hour period and six hour period at 40°, when the test is made upon flour. The same does not apply to wheat. There is however a large increase when the extraction is carried on for twenty-four hours.

There is a slight increase of acidity at 10° as the length of time of extraction is increased, but very little increase in the percentage of soluble protein at the same temperature by increasing the time of extraction.

The tempered wheat shows a little increase in soluble protein over the untempered, also a slight increase in acidity. This experiment was repeated a number of times always with the same results. The ratio of soluble protein to total protein is highest in the patent flour, diminishing as the grade is lowered. Jacobs (1) points out that this is due to the ash content. He states that the solubility of the nitrogen in flours is highest in the flour containing the least ash, decreasing with increase of ash content until an ash content of .50% is reached.

In order to determine how much the mineral salts would effect the percentage of soluble protein obtained the following experiment was carried out: Two samples of flour were taken the first a patent contained .368% ash, the second a clear flour contained .586% ash. These flours were extracted with well water containing 342 parts of mineral salts per million and with distilled water. The extraction was carried on for two hours, four hours, and six hour and twenty-four hour periods. The comparative results follow,—the letters have the same significance as in the previous table:

TABLE NO 2.—Using Distilled Water.

Sample	Per Cent. Moisture	Per Cent. Ash	Per Cent. Total Protein	Per Cent. Sol. Protein at 10°	At 40°
Patent	13.0	.368	10.36	2.16	2.68
Patent A	.....	.....	.....	2.20	3.08
Patent B	.....	.....	.....	2.20	3.08
Patent C	.....	.....	.....	.....	8.56
		Using Well Water.			
Patent	13.0	.368	10.36	2.20	2.20
Patent A	.....	.....	.....	2.16	2.36
Patent B	.....	.....	.....	2.16	2.36
Patent C	.....	.....	.....	.....	7.24
		Using Distilled Water.			
Clear	12.7	.586	11.88	1.76	2.04
Clear A	.....	.....	.....	1.72	2.36
Clear B	.....	.....	.....	1.76	2.44
Clear C	.....	.....	.....	.....	8.32
		Using Well Water.			
Clear	12.7	.586	11.88	1.72	2.12
Clear A	.....	.....	.....	1.72	2.36
Clear B	.....	.....	.....	1.72	2.44
Clear C	.....	.....	.....	.....	8.38

This shows that the mineral salts contained in the water affect the percentage of soluble protein obtained at the higher temperatures and longer extractions. At low temperature and short extractions their presence produces no change. There is no effect on clear flour.

As a result of this work, even considering the lack of ash in the patent flour one must conclude that the more soluble portions of the protein are contained in the interior portion of the wheat berry. A recent analysis of mill streams also shows this quite clearly.

All of the above determinations were made in duplicate. $N/_{20}$N a O H was used in making all titrations. The limit of error for the soluble protein was found to be .08%, if a larger error occurred the work was repeated.

The third series of experiments was conducted to determine the effect of various temperatures and length of time of extraction upon the percentages of reducing sugars and soluble extract. The samples were treated in the same way as those in the previous experiments, the same temperatures and extraction periods were used. The reducing sugars are calculated as crystallized maltose. The sugar determination was made according to the method of "Munson and Walker" (2). The soluble extract was determined by evaporating an aliquot portion to dryness at 100°.

The results are shown in Table III.

TABLE NO. 3.

Sample	Per Cent. Moisture	Per Cent. Ash	Per Cent. Protein	Per Cent. Maltose 10°	Room	40°	Soluble Extract 10°	Room	40°
Pat. 1	13.3	.368	10.36	1.29	2.21	2.71	3.19	5.24	8.01
Pat. 1A	.....	.....	.....	1.62	2.71	3.38	4.37	6.21	9.16
Pat. 1B	.....	.....	.....	1.96	3.04	3.96	6.45	7.85	9.94
Pat. 1C	.....	.....	.....	.....	4.80	6.80	.....	11.38	17.17
Str. I	12.0	.454	9.72	1.04	1.54	1.79	3.43	5.42	6.42
Str. IA	.....	.....	.....	1.29	1.87	2.46	4.23	5.97	7.23
Str. IB	.....	.....	.....	1.37	2.54	3.04	5.61	6.27	8.31
Str. IC	.....	.....	.....	.....	2.87	5.38	.....	10.24	15.28
Clear I	13.3	.562	11.80	.62	1.87	2.21	5.35	5.37	6.72
Clear IA	.....	.....	.....	1.29	2.79	2.96	6.27	7.89	9.03
Clear IB	.....	.....	.....	2.04	3.21	4.29	6.64	8.61	9.68
Clear IC	.....	.....	.....	.....	4.54	8.22	.....	11.40	17.38
Dry Wht. I	11.6	1.84	11.96	.46	1.04	1.12	4.54	5.07	5.93
Dry Wht. IA	.....	.....	.....	.87	1.29	1.62	4.48	5.70	7.41
Dry Wht. IB	.....	.....	.....	.95	1.37	1.79	5.49	6.33	7.70
Dry Wht. IC	.....	.....	.....	.....	.66	.14	.....	11.13	14.80
Temp. Wht. I	15.2	1.58	11.56	.52	.87	.95	5.58	6.34	7.85
Temp. Wht. IA	.....	.....	.....	.64	1.12	1.54	5.39	6.86	7.48
Temp. Wht. IB	.....	.....	.....	.95	1.29	1.96	6.02	6.98	8.03
Temp. Wht. IC	.....	.....	.....	.....	.68	none	.....	10.97	15.53

It will be noticed that the increase in reducing sugars and soluble extract is steady and in proportion to the length of time extracted and the increase in temperature.

It will also be noticed that the percentage of reducing sugars contained in the tempered wheat is rather lower than that contained in the untempered wheat. This was contrary to expectation. A number of trials, however, confirms this.

It is noticeable also that after the twenty-four hour extraction period on both wheats the reducing sugars had very nearly or completely disappeared.

All the above determinations were made in duplicate, the error in making the sugar determinations is about

.2%. The error in making the soluble extract determination is large, sometimes a variation of 1% being found.

The next series of experiments was carried out to determine the causes and effects of the soluble proteins and reducing sugars. The causes are of course self evident. Moisture and heat bring about these changes. No attempt was made to discover the active agent, bacteria or enzymes or perhaps both.

A large sample of wheat was taken and divided into six portions. Five were germinated in tin boxes. The bottom of the box was covered with sand. The sand covered with burlap, the wheat placed upon this and then covered with burlap. The wheat was spread upon the burlap about two inches thick. The wheat was tempered until it contained 15% moisture before being placed in the boxes. No water was afterward added.

The wheat was allowed to germinate for the following periods of time: No. 1, none; No. 2, three days; No. 3, four days; No. 4, six days; No. 5, seven days and No. 6, eight days.

The wheat did not sprout evenly. The following percentages of sprouted grains were counted after the wheat had been dried: No. 1, none; No. 2, four per cent; No. 3, six per cent; No. 4, eighteen per cent; No. 5, eleven per cent; No. 6, twenty-four percent. At the end of the germination period the wheat was uncovered, dried, and milled. Flour from all the samples was baked. The accompanying photographs show the results. No. 2 makes a better loaf of bread than the control sample No. 1. No. 3 is not nearly so good as the photograph shows, being very damp and sticky in the crumb.

The analysis of all the wheats and the flour made from No. 1, No. 2, and No. 6 follows. All extractions used in this series of experiments were for four hours. Under the heading "Moisture" is given the moisture content of the wheat at the end of the germination period and at the time of milling, the samples taken for analysis had the same moisture content as at the time of milling.

TABLE NO. 4.

Wheat.

Sample	Per Cent. Moisture (1)	Per Cent. Moisture (2)	Per Cent. Ash	Per Cent. Protein	Per Cent. Soluble Protein At 10°	Per Cent. Soluble Protein 40°	Per Cent. Acidity 10°	Per Cent. Acidity 40°	Per Cent. Maltose 10o	Per Cent. Maltose 40o
No. 1	11.2	11.2	1.86	12.04	1.60	2.04	1.35	2.70	.46	1.12
No. 2	24.0	16.0	1.92	11.96	1.80	2.68	.204	.450	1.48	3.19
No. 3	26.0	16.0	1.79	11.88	2.36	2.80	.204	.450	1.56	5.69
No. 4	27.4	17.5	1.80	11.72	2.36	5.00	.315	.810	3.74	9.77
No. 5	28.6	16.0	1.79	11.72	2.36	4.68	.270	.630	2.96	6.93
No. 6	28.6	18.5	1.64	11.64	3.00	5.88	.450	.900	4.66	10.91

Flours From Above Wheat.

Sample	Per Cent. Moisture	Per Cent. Ash	Per Cent. Protein	Per Cent. Soluble Protein At 10°	Per Cent. Soluble Protein 40°	Per Cent. Acidity At 10°	Per Cent. Acidity 40°	Per Cent. Maltose At 10o	Per Cent. Maltose 40o
No. 1	12.7	.58	10.74	1.64	2.12	.067	.135	1.34	2.54
No. 2	13.5	.62	10.64	2.20	3.16	.135	.245	2.90	5.32
No. 6	14.2	.60	10.52	2.52	6.36	.245	.450	7.72	15.16

CONCLUSIONS: (1) The maximum amount of acidity can be obtained with a four hour extraction at 40°. This is also a good time and temperature for determining soluble protein, there being no increase between the four hour and six hour period.

(2) For reducing sugars good comparable results could be obtained at any constant temperature and time. Perhaps the two hours at 10° would come nearer giving the absolute sugar contained in the sample, while four

hours at 40° would give a better idea of the diastic capacity.

(3) Room temperature is not to be recommended for any of these determinations.

(4) Increase of reducing sugars, acidity and soluble protein lead to inferior results in baking. It is true that a small increase gives better baking results, but how such a flour would behave during storage is an open question.

(5) It would be interesting to know how much further the reducing sugars, the soluble protein, acidity and soluble extract are increased during the fermentation of the dough and baking of bread.

REFERENCES: *(1) "Northwestern Miller," Sept. 2, 1914.*

(2) Bul. 107 (Revised) Bureau of Chem. Dept. of Agri.

H. E. WEAVER.

Service Star Members

M. E. SHULTZ, Med. Corps A. E. F.

LIEUT. R. W. MITCHELL, Chemical Service Section, Edgewood Arsenal, Md.

SERGT. JOHN C. WOODS, Munitions, Edgemont, Md.

LIEUT. RALPH S. HERMAN, Observation Corps, A. E. F.

W. A. GOLDTRAP, Engineering Corps.

CLARENCE SEEBER, Radio Service.

S. J. LAWELLIN.

LIEUT. L. R. OLSEN, Sanitary Corps. Base Hospital, Camp Upton, L. I.

Notes of Members

Leslie R. Olsen has left the laboratory, having been promoted to the position of sales manager of his company, The Eagle Roller Mills.

C. R. Southwell has left the employ of the Guthrie Mill & Elev. Co., and is now with the Southland Cotton Oil Co., at Oklahoma City, Okla.

A. R. Sasse is again with the Southwestern Milling Co., at Kansas City.

P. M. Patterson is again in the milling business, taking the place of R. W. Mitchell at the Kansas Milling Co., Wichita, Kansas.

Abstracts

A study of the chemical composition of thirty breads made with all kinds of substitutes, using 25% of substitutes and 75% of pre-war standard patent flour, described in bulletin 701 U. S. D. A. Bureau of Chemistry entitled "The Chemical Analysis of Wheat Flour Substitutes and the Breads Made Therefrom."

"A Preliminary Study of the Bleaching of Oats with Sulphur Dioxide," by Geo. H. Baston, U. S. D. A. Bulletin 725. This bulletin shows that the method of bleaching oats as practiced in this country is practically the same and is used only in wet seasons to conceal inferiority. Bleaching makes even badly bin burnt and ground damaged oats appear bright and of good quality but with very much reduced germinating power.

"The Chemistry of Wheat Flour Substitutes," by F. Stuhlman in Baker's Weekly, June 8, 1918.

"The Wheat Supply and the Baker's Loaf," by Chas. Hoffman in Baker's Weekly, May 25, June 1, 8, and 15, 1918. Results of experiments with milk, mineral salts, etc., in bread making.

"The Respiration of StoredWheat," is the title of an interesting monograph by C. H. Bailey and A. M. Gurjar published in the Journal of Agricultural Research, March 18, 1918.

"Nematode Galls as a Factor in the Marketing and Milling of Wheat." U. S. D. A. Bulletin 734. A new disease of the wheat plant and grain which is at present confined to Virginia.

Scottish Bakers Have Their Troubles

The following is a portion of a letter from one of our members, Mr. John Clark of the Regent Mills, Bunhouse Road, Glasgow, Scotland, which was written last March.

"The forms of admixture which we have been compelled to use are barley, rice, maize, rye, soy bean, etc. The length of flour extracted from wheat has been increased from 74 to 95% extraction. The chief danger of these admixtures is that they have a serious influence on the gluten and subsequently on the bread. Barley when added to wheat flour should not be more than five per cent of the mixture and no more extracted than 50 to 60% of the grain because there are proteolytic enzymes in the barley which tend to destroy the binding effect of the gluten. This is most noticeable in the dough possessing a stickiness representing signs of immaturity, while in reality it is over fermented.

Barley contains a large amount of silica. This material has a rupturing effect on the gluten cells and also produces a gritty feel in the dough. The quantity of gluten is seriously effected by various proportions of barley flour added. Thus in ten per cent there is 4% gluten loss, while in 50% barley flour added there is no gluten obtainable. I might mention that different barley possesses different degrees of proteolytic properties. Thus Scotch barley is less active than Canadian. As a rough guide to this, select the barley with the lowest nitrogen value. At present we are adding 25% barley of an extraction of 70% so you will have an idea what kind of flour it is making,—rubbish, however it is better offering rubbish than offering none at all.

Rice used has been unhulled and used up to 5% but at 5% it has a decided shortening effect on the dough which results in the bread coming out of the oven split in two. Maize has much the same effect as rice, a decided shortening effect and should not be added to wheat flour more than 20% or else a remarkable difference takes place. Rye has much the same effect on flour as barley only it is not so gritty. However, it possesses those proteolytic ferments which have a remarkable softening effect on the dough. In conclusion I may say that the most serious danger of all is in the increasing of the length of wheat flour. If you take our present standard 93% of the wheat, the bread made is decidedly dark and with an admixture of 25% of other cereals of a 70% extraction the color is passed talking about. However we seem to be surviving on it, of course we have been depending on imported flour to give us the necessary strength and assist the color; otherwise it would not be possible for us to make bread at all. The bran in this long length flour must be ground as fine as will pass through an ordinary flour silk cloth, otherwise the bran will cause a rupturing effect on the gluten cells while proving and liberate the gas resulting in a loss of volume in the bread.

In using a flour of this description the various processes used in bread have to be worked as cool as possible, with a minimum of yeast. Lately we have been using potatoes to the extent of one to seven and they have not so serious an effect as we anticipated. They certainly have a blackening effect on the bread but they produce a nice, soft loaf."

"Protein Hydrolysis"

The hydrolysis of wheat protein has been a subject of research for many years and has attracted the attention of some of our ablest and most prominent investigators. A great amount

of work has been done and considerable light has been thrown upon the subject, and a keener insight into the protein molecule and its chemical constitution has been obtained. The subject has been approached from many angles and different methods have been employed. An attempt to compare the results obtained by the different investigators would be rather difficult and misleading as their methods and conditions vary so widely. However, in most all this work there has been an attempt to obtain an indication of the baking strength of a flour from its chemical constitution. In this work we have tried to follow up the work that has been done and to carry it a little farther toward this viewpoint. While we are not able to show definite facts, we are able in our minds of drawing some very strong conclusions.

Since at present the only satisfactory method of obtaining the baking strength of a flour is by careful baking, before going into this work it might be well to make a short review of some of the other methods of determining the baking strength and some factors which may show the baking qualities.

The washing of gluten is probably the oldest method of obtaining an indication of the baking strength. The theory of applying the washed gluten as a means of determining the baking qualities is far more inaccurate than it is to use the same as a quantitative determination. The soluble proteins are not taken into consideration and these have been shown to have considerable effect. There is also a difference in the use of tap water and distilled water and the temperature of the water. These two conditions go to make the largest variation of any of the disqualifying factors.

Probably the first developed ratio was the ratio of the water soluble protein to the total protein. There is no doubt that the water soluble proteins play an important part in the baking, but it does not seem probable that a ratio so simple as this would give a true indication of the baking results. (2) Olsen states: "While it is true that the significance of the water soluble and gluten components of a flour to baking qualities are shown to a considerable extent in our experiments, it is impossible at this writing to express the importance of each."

The gliadin-glutenin ratio has been studied by a number of investigators. It has been shown that these two solutions, the alchol and the salt solution, do not dissolve pure proteins.

(1) Dried Gluten Becoming Obsolete. Vol. 1. No. 1. The Jr. of A. A. C. C.

(2) Bull. 144 State College of Washington. G. A. Olsen.

Blish says, "Owing to the fact that the solutions of varying strengths and different methods of extractions have been employed by different investigators, however, their results often disagree widely, and in many cases even fail to support the same general conclusions. Furthermore, it has been found that the solvents mentioned above are not specific as was formerly supposed, and that alcohol extracts not only gliadin but also considerable of the 'soluble proteins,' the material so extracted depending upon the strength of the alcohol, while salt solutions extract some gliadin as well as albumen and globulin according to the concentration of the solution." Thus it can be seen from a theoretical standpoint that this ratio would not hold, also the work in our laboratories on five different crops have failed to support this ratio.

There are several other ratios and factors which have been brought out from time to time, while each may have some bearing upon the subject, they do not seem to give consistent

results. (4) Bailey explains the problem very well when he says "Perhaps one of the reasons that a greater degree of success has not attended these endeavors is the fact that it has been attempted to discover one constituent (or group of constituents) which is the sole determining factor."

(3) On the Chemical Constitution of the Proteins of Wheat Flour. Jr. of Ind. & Eng. Chem. Vol. 8, No. 2.

(4) Canadian Miller and Cerealist. 5, 1913.

It does not seem reasonable to believe that in so complex a substance as wheat flour the percentage of one constituent can be regarded as solely indicative of baking quality. Rather must we study these various compounds in their relation to one another in an effort to arrive at their single and combined effects.

The method employed in this work was to take the different grades of flour from the mill, giving four flours from the same wheat, as patent, ninety-five, straight, and first clear from a hard winter wheat, a straight from durum, and a clear from soft wheat. A complete analysis and a baking test was made on each of these flours. There was a great difference in the baking qualities of the flours as shown in the table.

Grade	Ash	Prot.	Acid.	WSS.	WSP.	SSP.	Glia.	Glut.	Ratio.	Sor.	V. Sly.	Bake
No. 10 Pat.	.43	10.6	.112	7.58	1.56	1.8	5.7	3.1	1;1.8	.009	.008	Very Good
No. 11 95—	.52	11.5	.146	7.00	1.53	1.58	6.7	3.2	1;2.2	.004	.0137	Good
No. 12 St..	.68	12.5	.191	8.1	1.55	3.9	6.9	2.4	1;2.8	.018	.023	Good
No. 13 Cl.	.76	12.7	.189	8.2	1.53	2.2	6.2	4.3	1;1.4			Poor
No. 14 Du.	1.2	13.0	.214	6.7	1.38	3.2	7.3	2.5	1;2.9	.008	.0136	Very Poor
No. 15 Sof.	.48	9.5	.131	4.8	1.38	2.7	6.6	.2	1;44			Fair

The analysis does not seem to offer any indication of the baking qualities of the flour. The gliadin-gluten ratio is about the same for St. and Dur. yet there is a great difference in the baking qualities, while between Pat. and St. there is some difference in the ratio yet the baking qualities are the same.

The acidity does not seem to bear any relation to the baking qualities for Durum has a very high acidity and poor baking quality while Pat. and Straight one having high acidity and one having a low acidity both have about the same baking strength.

Since the chemical analysis of the flours do not give any indication of the baking strength it was decided to hydrolyze the flours and determine the nitrogen distribution in the different groups and if there was any variation of the units it might be some indication of the baking strength. The reason for using this method of analysis is that the protein molecule is of such a complex structure that it is necessary to use some method of breaking the molecule up into the simpler groups in order to get some idea as to its structure. There are something like seventeen amino acids together with ammonia, which are present in the form of acid amide groups, which form the basis of the composition of the protein molecule. All proteins contain these amino acids in various proportions and the character of the protein depends upon the relative proportions of these amino acids. As stated by Plimmer, (5) "We think of and work with proteins in terms of amino acids. All considerations and deductions as to the dietetic value of proteins can no longer be based upon their nitrogen content, but must be based upon the amounts of various amino acids in their molecule."

(5) The Chemical Constitution of the Proteins. Part 1, p. 4.

The washed gluten from the different flours were hydrolyzed first. It was necessary to determine at first

what length of time is required for complete hydrolysis. Different investigators have found that under various conditions hydrolysis was not complete in any one stated time but depending upon conditions. The method of determining when hydrolysis was complete was to heat the solution until the amino nitrogen was constant. Three grams of dried gluten was placed in a liter Erlenmeyer flask with 60 c.c. of 20% solution of hydrochloric acid. The flask was connected to a reflux condensor and the solution heated to boiling. At intervals of two hours 5 c.c. portions were taken out, diluted to 50 c.c. and 10 c.c. used in determining the amino nitrogen according to the VanSlyke Method. In this determination the reaction is allowed to proceed for five minutes standing and two minutes shaking. Under these conditions the same proportion of ammonia is decomposed.

St. Grade	2 hrs.	9.40%
	4 hrs.	10.65%
	6 hrs.	10.85%
	8 hrs.	10.82%
	12 hrs.	10.80%
Durum	2 hrs.	7.30%
	4 hrs.	7.83%
	6 hrs.	7.89%
	8 hrs.	7.90%
	12 hrs.	7.90%

From these results it was concluded that hydrolysis was very nearly complete in eight hours. Wood used eight hours hydrolysis but VanSlyke has shown that hydrolysis of pure gliadin was not complete at the end of eight hours. However, the conditions under which the two worked might have been different, but the results here seem to indicate that under the conditions which the work was performed that hydrolysis was complete.

For the analysis of the different samples the same weight of sample and acid was used as in the preliminary work. The nitrogen distribution was determined in the following groups:

I. Humin Nitrogen, which is the nitrogen in the black residue remaining from hydrolysis.

II. Ammonia Nitrogen, which is present in the protein as the amide by which the various amino acids are linked together.

III. Amino nitrogen, which is the nitrogen of the amino acids.

IV. Basic nitrogen, which is the non-amino nitrogen of the amino acids and the nitrogen of the hexone bases.

The solutions were hydrolyzed for eight hours and allowed to cool. The excess hydrochloric acid was distilled off and the solution filtered. The residue was washed well with hot water and the filtrate made up to 250 c.c.

(1) Humin nitrogen. The residue was subjected to analysis for nitrogen. The total nitrogen of the filtrate was determine' on 25 c.c. aliquot, this added to the human nitrogen gives the total nitrogen and all percentages are based upon this.

(2) Ammonia nitrogen. Since Cystine is decomposed by boiling at 100°C. the determination of the ammonia was carried out in a vacuo at 40°C. Fifty c.c. of the solution was made alkaline, the ammonia distilled off under the reduced pressure and collected in the standard acid.

3 Amino nitrogen. The residue from the ammonia distillation was made neutral and made up to 50 c.c. and 100 c.c. used in the Van Slyke. A description of Van Slyke apparatus and the principle may be found in Mathews' Physiological Chemistry, page 974, or in The Chemical Constitution of the Proteins, Part I., Plimmer, page 90.

For the hydrolysis of the entire flour 10 gram samples were used and

200 c.c. of 20% solution of hydrochloric acid. The nitrogen distribution was determined in the same group as in the dried gluten. The method in detail is as follows:—10 grams of flour was heated with 200 c.c. of 20% solution of hydrochloric for 8 hours. The excess hydrochloric distilled off, the solution filtered and the residue washed well with hot water. The nitrogen determined in the residue and the filtrate made up to 250 c.c. and the total nitrogen in the filtrate determined. This added to the humin nitrogen gives the total nitrogen. As an example of analysis:

Residue Nitrogen	.00430 gr.	2.05%
Nitrogen in filtrate	.20600 gr.	
Total nitrogen	.21030 gr.	
Amonia Nitrogen	.0443 gr.	21.50%
Amino Nitrogen	.1350 gr.	64.30%
Basic Nitrogen		12.15%

Dried Gluten

	No. 10	No. 12	No. 13	No. 14	No. 15
Humin	1.80	1.70	1.84	2.48	.25
NH3	21.3	22.8	22.2	21.6	18.5
Amino	57.7	63.6	61.5	60.0	68.5
Basic	17.2	12.9	14.46	15.92	12.75

Whole Flour

No. 10	No. 11	No. 12	No. 13	No. 14	No. 15
4.95	4.50	2.05	1.57	2.42	2.10
20.8	21.0	21.5	21.4	22.1	20.54
64.5	64.0	64.3	63.0	60.0	62.0
9.75	10.5	12.15	14.03	15.48	15.36

From the data we can see that there is no relation between the analysis of the dried gluten and the whole flour. The results shown are not from single determinations but they are the average of several determinations and the variations are larger than would be due to experimental error. It might occur to some that the presence of starch in the flour would cause a variation from that of the dried gluten. Numerous experiments by several men have shown that starch has very little effect upon the products from hydrolysis. So we decided not to try to draw any conclusions from the hydrolysis of the dried gluten but to base our conclusions on the hydrolysis of the entire flour.

It has been pointed out by Blish and others that the percentage of ammonia nitrogen yielded from the hydrolysis of the water soluble proteins was smaller than that yielded from the hydrolysis of the dried gluten or the entire flour. Therefore flours with a large percentage of soluble nitrogen should yield the smaller percentage of ammonia from the hydrolysis of the entire flour. In the following tables we have arranged our samples in order of the percentage of the water soluble nitrogen of the total nitrogen.

TABLE NO. 3.

Sample.	Total Prot.	W.S.P.	W.S.N	After hydrolysis of entire flour NH3 nitrogen	Amino N	Baking St.
No. 10. Patent	10.60	1.56	14.70	20.80	64.50	Very Good
No. 15. Soft	9.46	1.38	14.50	20.54	62.00	Fair
No. 11 95%	11.50	1.53	13.30	21.00	64.00	Good
No. 12. Straight	12.48	1.55	12.40	21.50	64.30	Good
No. 13. Clear	12.70	1.53	12.00	21.40	63.00	Poor
No. 14. Durum	13.08	1.38	10.50	22.10	60.00	Very Poor

Table 3 shows that those flours with the high percentage of water soluble nitrogen yielded the lower percentage of ammonia nitrogen upon hydrolysis of the entire flour. The percentage of amino nitrogen yielded does not seem to have any direct relation to the water soluble nitrogen. The percent of ammonia nitrogen may also serve to indicate the amount of various proteins present.

In order to obtain some relation between the data given here and the baking strength of the flour, we shall

take the three most important factors into consideration, namely:—the per cent of water soluble nitrogen, the per cent of ammonia nitrogen and the per cent of amino nitrogen. Our experience has shown us that no single one constituent will give us any true indication of the baking strength so we have attempted to establish a three phase ratio, that is; the ratio of the water soluble nitrogen to the amino nitrogen and ammonia nitrogen. This ratio may at first seem somewhat complex but after a little investigation it becomes quite simple. The formula may be expressed as follows:

	$\frac{\text{Amonia nitrogen}}{\text{Soluble nitrogen}}$		$\frac{\text{Amino nitrogen}}{\text{Soluble nitrogen}}$	
	Soluble N	Ammonia N	Amino N	Baking Qualities
No. 10	1	1.34	3.70	Very Good
No. 11	1	1.58	4.80	Good
No. 13	1	1.78	5.25	Poor
No. 14	1	2.10	5.71	Very Poor

From these results it indicates that the higher ratio of ammonia nitrogen and amino nitrogen to the water soluble nitrogen the poorer the baking qualities, or for a flour to have a good baking quality the ratio of ammonia nitrogen and amino nitrogen to the soluble nitrogen should be low. We are not able to state the numerical values of these ratios at present for we have not analyzed enough samples and would have to have the results on several different crops, but from our work we feel sure that by collecting more data that we would be able to state definitely the values these ratios should have and the limits within which they can vary. It would be possible to have a flour whose ratio of water soluble nitrogen to ammonia would indicate a flour of good baking qualities but whose ratio of amino nitrogen would be out of proportion and would be a flour of good quality. As will be shown it is possible to alter the various percentages of nitrogen in the different groups by the use of different reagents.

As most flour improvers usually contain oxygen in some form we decided to treat some flour with a solution of hydrogen peroxide and then hydrolyze it and determine the nitrogen distribution as before. Sample No. 13, which is a straight grade flour, was treated with 1½% solution of hydrogen peroxide for 8 hours. The excess was distilled off and then hydrolyzed with acid. The analysis before and after treatment follows:—

	Before	After	
Humin N.	2.05%	1.64%	
Ammonia N.	21.50″	27.20″	5.7% increase
Amino N.	64.30″	58.50″	5.8% decrease
Basic N.	12.15″	12.66″	

These results indicate that there is an increase in the ammonia nitrogen and a corresponding decrease in the amino nitrogen. As suggested by Patterson (5) "that by oxidizing the amino compounds with hydrogen peroxide a ketonic acid and ammonia is formed.

As an example of the amino compounds which are present we take alanine:

$$\begin{array}{lcl} CH_3 & & CH_3 \\ | & & | \\ H\text{-}C\text{-}NH_2 + O = & & H\text{-}C\text{-}O + NH_3 \\ | & & | \\ COOH & & COOH \\ \text{Alanine} & & \text{Pyruvic Ammonia} \end{array}$$

It can be seen from this reaction that there would be a decrease in the amino nitrogen and a corresponding increase in the ammonia nitrogen. Our data shows this to be true for we have a 5.7% increase in the ammonia nitrogen and a 5.8% decrease in the amino nitrogen. These results are within the limits of experimental error and are the average of several determinations. This supports our conclusions that in order to get any indication of the baking strength we must take all the different nitrogen groups into consideration, for by changing the percentages in these groups we can change the baking qualities. Now we know from experience that hydrogen peroxide is a flour improver and gives better volume to the bread so that by controlling the ratio of the ammonia nitrogen and amino nitrogen we should be able to improve the baking strength of a flour.

SUMMARY.

(1) The various ratios as the ratio of water soluble nitrogen to total nitrogen, or gliadin-glutenin ratio, while they may have some bearing upon the baking qualities, do not give a true indication of the baking strength of the flour and cannot be relied upon.

(2) Upon hydrolysis of the entire flour consistent and reliable results can be obtained and the ratio of the nitrogen in the amino and ammonia groups to the water soluble nitrogen seems to have a direct bearing upon the baking qualities.

(3) That it is possible to alter the percentage of ammonia and amino nitrogen in the distribution groups upon hydrolysis of the flour and thereby alter the baking strength.

(4) That it will be possible to establish a three-phase ratio that is of the percentage of ammonia nitrogen and amino nitrogen to the percentage of soluble nitrogen within close numerical limits which will give a true indication of the baking strength.

C. J. PATTERSON,
L. M. MCLAREN.

A joint meeting of The Society of Milling and Baking Technology and The American Association of Cereal Chemists was held in Chicago, February 15 last. One or two of the scientists present were assigned to assist the State Food Administration staffs in an advisory capacity for bakers in regard to the use of substitutes. Resolutions were passed endorsing the mixed cereals program of the Food Administration.

FOR SALE.

Despatch Electric Baking Oven, Style No. 100 for direct current. Outside length 44 inches. For particulars write Eagle Roller Mill Co., New Ulm, Minn.

The Enzymes Present In the Dry Wheat Kernel

At a very early date in the history of physiological bodies, catalysts other than inorganic were isolated from living organisms, even as early as the sixteenth century there were theories as to the action of juices in the stomach during digestion.

Abbe Spallozani fed sponges attached to strings to birds of prey, then took the liguid expressed from them and used it in the artificial digestion of meat. The meat was liquified and changed.

Reaumur fed metal tubes with holes filled with albumins and starchy substances to hawks. He examined the tubes after they had been cast out and found that the albumins had been liquified, and the starchy materials had undergone no change. These actions were due to ferments known today as enzymes.

In 1830 Dubrunfaut prepared an extract from malt that converted

starch into sugar, just as strong acids were known to do. (Later known as diastase.) Three years later diastase was prepared by Payen and Persoz. As more and more of these bodies were discovered they were given the name ferments. After the classic work of Pasteur on ferments and his discovery that some of these actions were due to living organisms; diastase like ferments were called soluble or unorganized ferments in contradiction to living organisms which were called insoluble or organized. This double wording gave rise to much confusion so Kuhne proposed the name enzymes for the unorganized ferments.

Enzymes are very difficult to define because there is so little known about them, except through their reactions. It seems to be the consistent opinion of the best authorities that they are colloidal catalysts; considered under a separate head, because they are produced by living organisms, and are for the most part, of unknown chemical constitution. Some of the components of them have been determined by analysis: viz. manganese and iron. Whether these metals are present as impurities or are a necessary component is at present unknown; although their presence in certain instances are known to accellerate the action of certain enzymes. Colloidal solutions of some metals will in some instances duplicate the actions of enzymes; as colloidal platinum possesses the properties of a true enzyme, those of an oxidase. Some authorities contend that enzymes are not all colloids, for they might be a constituent in the system of a substance which is colloidal. Also whether enzymes start a new reaction or accelerate one already started has not been definitely settled.

The meaning of the different enzymes, as in the beginning of chemistry is at present very confusing. Although the name in general is derived from the "substrate" or substance acted on by the particular enzyme; as proteinase for those which act on proteins; and amylase for those whose "substrate" is starches.

EXPERIMENTAL PART.

The determination of the different group enzymes only were undertaken in this paper and these only qualitatively. All determinations were made in duplicate but only a mean value will be given. The ground whole wheat was used in all determinations. This ground whole wheat will be referred to in this paper as meal.

LIPASE—This enzyme was found to be present in small amounts. This conclusion was arrived at by the following experiments.

Experiment 1:

(a) 5 c.c. ethyl acetate, 1 gram meal, 50 c.c. water, few c.c.'s of toluene, the mixture heated at 37 degrees for 24 hours, after which 25 c.c. was taken for titration with N/10 NaOH.

(b) 5 c.c. ethyl acetate, 50 c.c. water treated the same as above.

(c) 1 gram meal, 55 c.c. water treated as above.

Results:

(a) 25 c.c. 3.80 c.c. N/10 NaOH.
(b) 25 c.c. 0.30 c.c. N/10 NaOH.
(c) 25 c.c. 0.10 c.c. N/10 NaOH.

The sum of (b) and (c) is less than (a) therefore showing a slight saponification.

Experiment 2:

(a) 5 c.c. olive oil, 1 gram meal, 50 c.c. water; heated as in experiment 1, and 25 c.c. used for titration.

(b) 5 c.c. olive oil, 50 c.c. water; treated as above.

(c) Same as (c) above.

Results:

(a) 25 c.c. 2.10 c.c. N/10 NaOH.
(b) 25 c.c. 0.45 c.c. N/10 NaOH.
(c) 25 c.c. 0.10 c.c. N/10 NaOH.

The sum of (b) and (c) is less than (a), therefore showing a slight saponification.

AMYLASE—Considerable quantities of this enzyme was shown by the following experiments.

Experiment 1:

(a) 1 gram of meal, 10 c.c. 1% starch solution, 50 c.c. water, and the mixture heated to 60 degrees for 1 hour, then heated to boiling and filtered.

(b) 1 gram of meal, 60 c.c. water; treated as above.

(c) 10 c.c. 1% starch solution, 50 c.c. water; treated as above. Determine the reducing sugar in the filtrate by the method of Kendall, the copper being titrated with N/10 sodium thiosulphate. The results being expressed in c.c.'s of N/10 sodium thiosulphate.

Results:

(a) 12.3 c.c. N/10 sodium thiosulfate.

(b) 0.8 c.c. N/10 sodium thiosulfate.

(c) 4.1 c.c. N/10 sodium thiosulfate.

The sum of (b) and (c) is less than (a), thus showing amylase to be present.

COAGULASE—This enzyme was tested for but found to be absent. The following experiments were tried. Fresh milk was treated with one-tenth of its volume with 20% calcium chlorine solution and then used as follows:

Experiment 1:

(a) 10 c.c. of prepared milk, 1 gram meal.

(b) 10 c.c. of prepared milk.

(c) 10 c.c. of prepared milk, 0.2 c.c. N/10 acetic acid.

(d) 10 c.c. of prepared milk, 0.2 c.c. N/10 n-butyric acid.

The last two represent an excess of the amount of acidity developed in one gram of material at 37 degrees for 24 hours. All the above mixtures were kept at 37 degrees for 24 hours. No marked change took place at the end of digestion and the milk could quite easily be poured.

BETA GLUCOSIDASE — This enzyme was found to be present in small quantities. This was confirmed by the power of this enzyme to split up the glucoside amygdaline into glucose, benzaldehyde and hydrocyanic acid and the glucose present estimated.

Experiment 1:

(a) 1 gram meal, 0.25 grams amygdaline plus 50 c.c. water.

(b) 1 gram meal, 50 c.c. water.

(c) 0.25 gram amygdaline, 50 c.c. water.

The above mixtures were digested at 37 degrees for 24 hours and 5 c.c. pipetted from the supernatant liquid and its reducing power determined by Kendall's method.

(a) 7.4 c.c. of N/10 sodium thiosulfate.

(b) 0.3 c.c. of N/10 sodium thiosulfate.

(c) None.

The sum of (b) and (c) is less than (a). (a) also had a very strong odor of benzaldehyde.

SURCASE—The presence of this enzyme was confirmed by the following experiments.

Experiment 1:

(a) 2 c.c. 10% cane sugar solution, 1 gram of meal, 50 c.c. water.

(b) 1 gram meal, 52 c.c. water.

(c) 2 c.c. 10% cane sugar solution, 5 c.c. N/10 sulfuric acid, 45 c.c. water.

(d) 1 gram meal, 5 c.c. sulfuric acid N/10, 47 c.c. water.

All the above mixtures kept at 37 degrees for 24 hours the solutions brought to boiling and filtered and the reducing sugar determined by Kendall's method.

Results:

(a) 11.9 c.c. N/10 sodium thiosulfate.

(b) 3.9 c.c. N/10 sodium thiosulfate.

(c) 2.3 c.c. N/10 sodium thiosulfate.

(d) 44.6 c.c. N/10 sodium thiosulfate.

The sum of (b) and (c) is less than (a).

OXIADSE AND PEROXIDASE—The results of the following tests show the presence of both of these enzymes.

Experiment 1:

(a) 1 gram pyrogallol, 1 gram meal, 10 c.c. 1% H_2O_2.

(b) 1 gram pyrogallol 50 c.c. water.

Experiment 2:

(a) Small amount of guaiacum emulsion, 1 gram meal, 10 c.c. H_2O_2.

(b) Same as above except H_2O_2.

Experiment 3:

(a) 5 c.c. cresol, 1 gram meal, 50 c.c. water, 10 c.c. 1% H_2O_2.

(b) Same as above except peroxide.

All of these mixtures kept at room temperature for 24 hours.

Results:

Exp. 1 (a) brown color was formed. (b) light brown color.

Exp. 2 (a) Deep blue color at once in both cases.

Exp. 3 (a) Very slight blue color if any. (b) deeper blue color than in (a).

PROTEINASE—The presence of this enzyme was tested for by the following experiments.

Experiment 1:

(a) 1 gram meal, 50 c.c. 2% peptone solution, 1 c.c. toluene.

(b) 1 gram meal, 50 c.c. water, 1 c.c. toluene.

(c) 50 c.c. 2% peptone solution, 1 c.c. toluene.

Kept all at 37 degrees for 24 hours, took 25 c.c. of the liquid after digestion and treated with 50 c.c. water and 10 c.c. neutral formol phenolphthalein solution and titrated with N/10 NaOH.

Results:

(a) 25 c.c. mixture 10.7 c.c. N/10 NaOH.

(b) 25 c.c. mixture 0.3 c.c. N/10 NaOH.

(c) 25 c.c. mixture, 9.0 c.c. N/10 NaOH.

This experiment shows very slight splitting due to enzyme.

Experiment 2:

(a) 1 gram meal, 50 c.c. gelatine.

(b) 50 c.c. gelatine.

The above was kept at 20 degrees for 48 hours (a) was completely liquified while (b) showed no change.

The presence of this enzyme can not be considered confirmed by these experiments. Although it is probably in some of its various forms present. The experiments on this group has not been finished, and cannot come to any conclusions at present.

Conclusions:—

The enzymes found present so far are lipase, amylase, beta-glucosidase sucrase, oxidase, peroxidase, and probable presence of proteinase. Coagulase was found to be absent.

The presence of these enzymes in all probability have a very decided influence on the wheat kernel, especially during tempering and storing and even during milling.

According to Kosutany, gliadin and glutenin are capable of being transformed into each other by enzymic action.

To give some idea what the enzymes found to be present in the wheat kernel might have on the products, some of the general properties are given below.

Lipase is the enzyme which acts on fats and esters forming fatty acids, alcohols and glycerol.

Amylase is the enzyme which transforms starch into maltose.

BetaGlucosidase transforms glucosides and polysaccharides into glucose, sugar and alcohol.

Sucrase inverts cane sugar.

Peroxidase gives when acting on peroxides a very active form of oxygen.

Oxidase effects oxidation of purine bases, converts alcohols and aldehydes into acids, transforms simple substitute phenols, amines, amino-acids and their derivatives into quinone compounds.

Proteinase—Converts proteins, albumoses, peptides, peptones, into peptides and amino-acids.

J. R. HESS.

U. S. Food Conservation Notes

Minimum Fat Ration

It will be remembered that the International Scientific Commission recently announced its conclusion that the desirable daily minimum ration of fat for an average man should be 75 grammes, or 2⅝ ounces. At first sight this seems to be a heavy allowance, but it is well within normal European consumption and considerably below the American standard. Happily there are at present supplies of bacon and lard which make it possible to meet all reasonable demands. The whole disputed question of the amount of fat required to keep the body in good health is discussed by Prof. Starling in a very interesting paper in the current number of the British Medical Journal. The demand for fat varies very much according to the nature of the work and the climate. Heavy workers in a cold atmosphere require a very large proportion of fat in their diet. American lumbermen consume up to 388 grammes (13½ ounces) a day, and Swedish woodcutters from 7 to 13½ ounces, while the ordinary sedentary European is content with quantities varying from 1½ to 5½ ounces.

From the various data available, Prof. Starling reaches the tentative conclusions that although, strictly speaking, there is no evidence for an absolute physiological minimum of fat in an otherwise abundant diet, the development of the human alimentary canal makes it necessary in practice to supply a considerable proportion of fat in food. In the diet of the infant at the breast fat gives over 50 per cent of the total energy, and the child requires 2 ounces a day of fat up to 10 years. It appears to the British Medical Journal that the minimum figure for adults, given by the Scientific Commission, may be diminished without serious detriment to the health of the individual, though probably not without inconvenience and diminution of efficiency, but that it may be considerably increased without interfering with efficiency or with health.

Investigation of Peroxide Process

The effect of hydrogen peroxide on flour, accomplished by the tempering of wheat with different amounts of this substance was determined as follows:—

TEMPERING

Sample No.	Grams Wheat Used	C.C. of Water First Temp.	C.C. of Peroxide Solution of Diff. Strengths	% of 3% H_2O_2 Tempered Wheat	% of Absolute H_2O_2 in Temp. Wheat	Time of First Temper	Time of Second Temper	Time Milled
1	1200	40	20	0.278	0.0084	Dec. 3	Dec. 4	Dec. 4
						2:00 P.M.	8:30 A.M.	12:00 P.M.
2	"	"	"	0.139	0.0042	3:15 P.M.	9:45 A.M.	2:00 P.M.
3	"	"	"	0.0696	0.0021	4:30 P.M.	11:00 A.M.	3:00 P.M.
4	"	"	"	0.0348	0.00105	Dec. 4	Dec. 5	Dec. 5
						2:00 P.M.	8:00 A.M.	12:00 P.M.
5	"	"	"	0.0174	0.00052	3:00 P.M.	10:00 A.M.	2:00 P.M.
6	"	"	water	none	none	4:00 P.M.	10:00 A.M.	3:00 P.M.

The time of tempering was the same in each case and the peroxide solution used as the second temper was allowed to stand four hours before milling.

MILLING

Sample	Yield Basis	Per Cent. Patent	Per Cent. Clear
1	4/40	71.4	28.6
2	,,	70.2	29.8
3	,,	70.2	29.8
4	,,	72.0	28.0
5	,,	70.8	29.2
6	,,	71.4	28.6

All samples were milled in two grades, patent and clear with low grade in. The tests were made on the patent grades as it was considered more uniform. The flours were placed in jars and after all were milled they were transferred to bags for 24 hours and then returned to the glass jars.

BAKING TEST

Stiff Dough. Baked Dec. 7, 1917.

Sample	1	2	3	4	5	6
Moisture	8.78	8.35	8.36	8.90	9.32	9.06
Given Absorption	62	62	62	62	62	62
Relative Stiffness	103	104	102	101	100	100
Volume	100	100	100	100	100	100
Color	100 dull	100	100	100	100	100
Texture	99.5	100	100	100	100	100

Medium Stiff Dough.

Sample	1	2	3	4	5	6
Absorption given	66	66	66	66	66	66
Relative Stiffness	102	103	101.5	101	100	100
Volume	100	100	100	100	100	100
Color	100D	100	100	100	100	100
Texture	100	100	100	100	100	100

Soft Dough.

Sample	1	2	3	4	5	6
Absorption given	70.	70	70	70	70	70
Relative Stiffness	102	103	102	100.5	100	100
Volume	100	100	100	100	100	100
Color	100W	100W	100W	100W	100W	100 Cr.
Texture	100	100	100	100	100	100.

In the following tests sufficient water was added to each flour so as to make them of the same consistency.

"Doughs of Equal Stiffness."

Sample	1	2	3	4	5	6
Absorption	64.5	65.2	63.8	63.5	62.9	62.7
Relative Stiffness	100	100	100	100	100	100
Volume	100	100	100	100	100	100
Color	99.5	100W	100W	100W	100W	100
Texture	99.5	100	100	100	100	100

"ANALYSIS"

Sample	1	2	3	4	5	6
Wet Gluten	37.15	37.60	37.00	36.05	35.15	36.20
Dry Gluten	11.52	11.45	11.40	10.97	10.92	11.10
Color Gluten	Brown	Brown	Brown	Cream	Cream	Cream
Acidity	.104	.105	.100	.104	.104	.104
% peroxide 3% in temp. wheat.	.278	.139	.0696	.0348	.0174	none

As a check two more samples were milled, one treated with 0.0696% peroxide and the other with water.

Sample	Treated	Water
Color	100	100
Volume	100	100
Texture	100	100
Absorption	62	60
Dry Gluten	10.7	10.45
Acidity	0.097	0.095% as lactic

All the above results were calculated to a 13.50% moisture basis.

CONCLUSION

By treating wheat with .139% peroxide (3%) the flour made therefrom will absorb 2 to 2.5% more water.

The acidity was not effected by the treatment.

Higher amounts of dry gluten were found on the treated samples 1, 2 and 3.

A. R. SASSE.

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